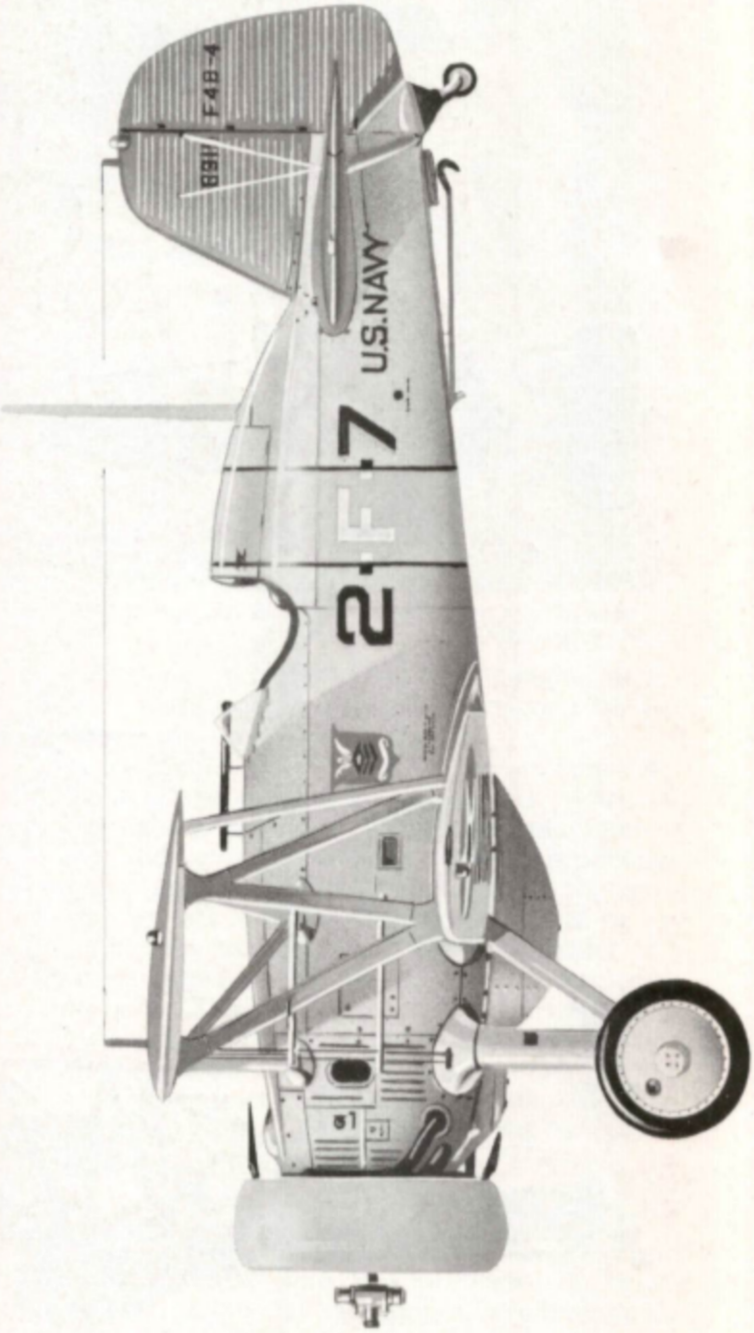
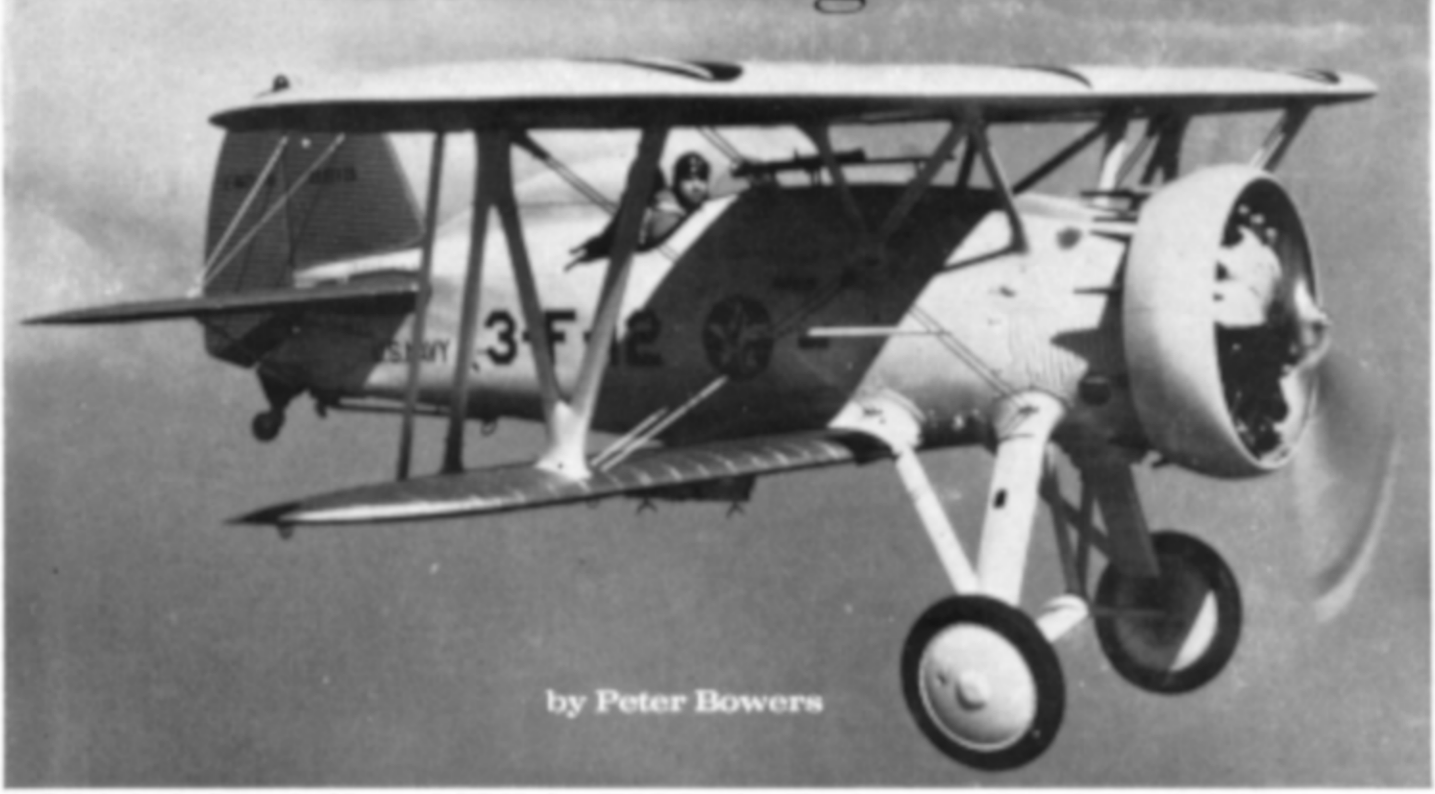
PROFILE PUBLICATIONS

The Boeing F4B-4


F4B-4
8911
U.S. NAVY
2-F-7

NUMBER 27
TWO SHILLINGS

The Boeing F4B-4



by Peter Bowers

An F4B-4, the third aircraft of Section 1, VF-3B, from U.S.S. Langley. *Though not painted here, the lower half of the Townend ring should have been red.* (Photo: U.S. Navy)

The Boeing Airplane Company of Seattle, Washington, started out as the principal supplier of fighter aircraft to the U.S. Navy for the years 1925–33 as the result of Navy interest in fighters that Boeing had built for the U.S. Army. Boeing's experience in the manufacture of U.S. Naval aircraft dated back to 1917, nearly a year after the formation of the company as Pacific Aero Products in July 1916. Soon after U.S. entry into World War I in April 1917, the Navy ordered two examples of the Boeing Model C two-seat seaplane trainer for evaluation, the order being placed just before the name of the company was changed to Boeing Airplane Company in May 1917. Testing of the first Model Cs resulted in an order for 50 production versions which were delivered in 1918. Additional Navy production during World War I consisted of the manufacture of 25 Curtiss-designed HS-2L single-engine patrol flying boats.

In the early post-war years, Boeing's principal customer was the U.S. Army. Orders for new machines were scarce and the majority of the work consisted of rebuilding obsolescent D.H.4 "Liberty Planes", the notorious American-built version of the original British design of 1916. Following military policy of the period, the Army designed some of its own aircraft and then contracted with the industry to build them. Under this arrangement, Boeing built 10 examples of the ungainly Liberty-powered GA-1 twin-engine attack triplane and two GA-2 single-engine attack biplanes with the experimental Army-designed 750-h.p. W-1 three-bank water-cooled engines.

Another peculiar practice of the period concerned aircraft design procurement by the Army. When the Army bought a prototype from a manufacturer, it also acquired the manufacturing rights. If production of the new model was considered desirable, the entire domestic aircraft industry was invited to bid on the order, with the result that a firm having better production facilities than the original designer frequently won the order. This proved to be the case with Boeing, and it entered the fighter business in 1920 by winning a production order for 200 MB-3As—improved versions of a single-seater designed by Thomas-Morse in 1918. The designing firm received an order for only 50 MB-3s after building four prototypes.

BOEING DEVELOPS NEW STRUCTURE

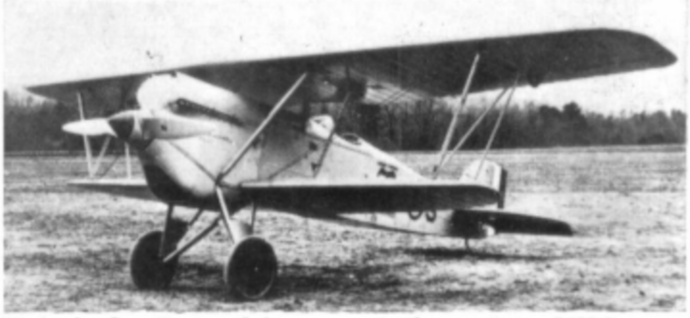
As a result of the MB-3 contract, Boeing became thoroughly familiar with the problems of fighter design, construction and operation. It also realised the shortcomings of established structures which had been developed early in World War I. The wire-braced wooden fuselage, with its mass of metal fittings, was not only a costly manufacturing headache but a major maintenance problem. Boeing engineers had been quick to appreciate the advantages of welded steel

Left: *Boeing's first fighter, the MB-3A, 200 of which were built to Thomas-Morse design.* Right: *Boeing Model 15 as tested by U.S. Army before purchase as XPW-9.* (Photos: U.S.A.F.)

tube fuselage construction, having initially encountered it in war-prize German Fokker D-VIIs (see *Profile* No. 25) on hand in the U.S. Three had been sent to Boeing, two for destructive structural testing and one flyable two-seat conversion for use by Army personnel at the plant during production of the MB-3As. Further information on steel tube structures and thick-section cantilever wing design was obtained by Boeing engineers visiting the new Fokker factory in Holland during a fact-finding European tour.

New fighter designs were proposed to the military but were turned down because enough aircraft existed to meet current needs and no funds were available for development of new designs. In the face of such Government apathy, Boeing decided to gamble on the demonstration of a new privately developed design, superior to Army models then on hand or projected, creating a market for itself where "paper" designs could not. Consequently, the building of three prototypes of a new fighter, the Boeing Model 15, was authorised at company expense. Other than the thick-section tapered wings, which were new to American design practice, the outstanding feature of the new model was the steel tube fuselage, assembled by a Boeing-developed arc-welding process instead of the gas-welding system used by Fokker. The Army showed interest, but was still unable to support the project financially. It did, however, agree to loan three new 435-h.p. Curtiss D-12 engines, instruments and accessories, and to test the aircraft at the Air Test Centre at McCook Field, Dayton, Ohio, on a bailment contract.

The first Model 15 completed its company tests in September 1923 and was delivered by rail to McCook Field, where the Boeing gamble paid off almost immediately. The Army decided to buy the flying prototype and the two unfinished aircraft, and designated them PW-9 (i.e. Pursuit, Watercooled, Model 9). These became XPW-9 in 1924 when the X-prefix was added to standard designations to indicate prototype or other experimental status. A production order for 30 slightly improved PW-9s followed. The Army was so pleased with the tapered wing of the XPW-9 that it asked Curtiss to fit similar wings to its existing PW-8 model which was a straight-wing design; the resulting XPW-8B was so successful that it became the prototype of the long line of tapered-wing Curtiss "Hawk" fighters.



FB-1, the first Boeing fighter, was similar to Army PW-9. (Photo: U.S. Navy)

EARLY BOEING NAVY FIGHTERS

The Navy was also impressed by the new model and ordered 10 similar examples for the U.S. Marine Corps under the Navy designation FB-1* (Navy serial numbers *A-6884* to *A-6893*). These were the direct Naval ancestors of the famous F4B-4 fighters. The FB-1s were intended to operate from land bases and were not equipped with aircraft carrier arrester gear; the Marines operated them for a while in China following their delivery in December 1925.

Two improved FB-2s (*A-6894*, *A-6895*) were developed for carrier operation and were essentially FB-1s with arrester hooks and re-designed landing gear. Three FB-3s (*A6897*, *A-7089*, *A-7090*) used similar airframes but were fitted with larger Packard 1A-1500 engines. The landing gear was again different and provision was made for the installation of twin wooden pontoons. A single FB-4 (*A-6896*) served as a test bed for a new Wright P-1 air-cooled radial

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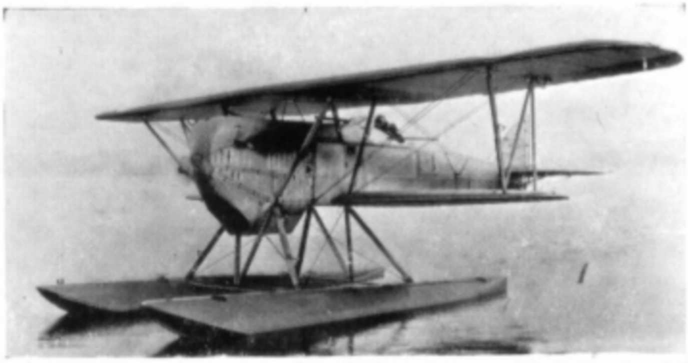
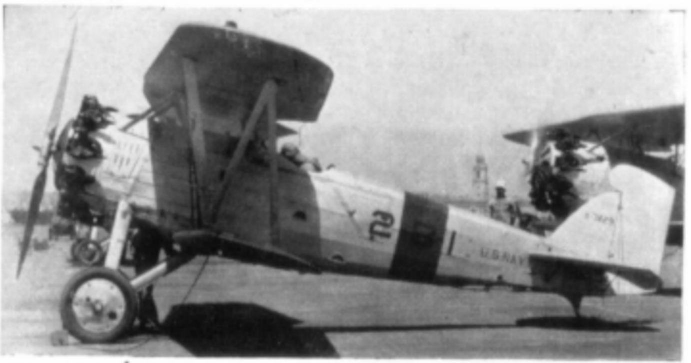
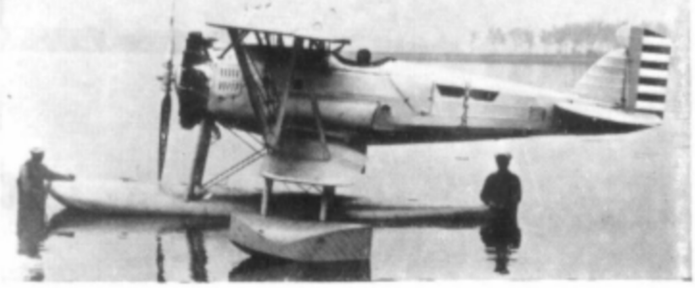
*Under the designation system adopted for Naval aircraft in 1922, the first letter identified the design as a fighter and the second the manufacturer, Boeing. The -1 indicated the first configuration of the new model. Minor variations were identified as FB-2, FB-3, etc.

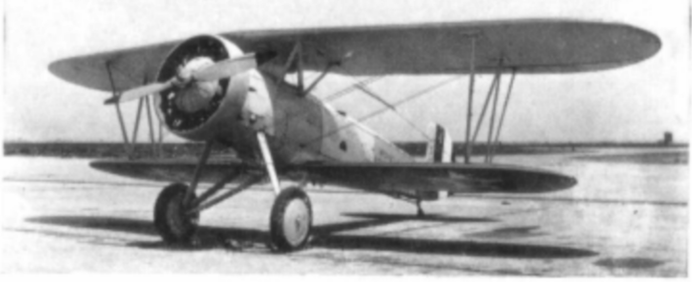


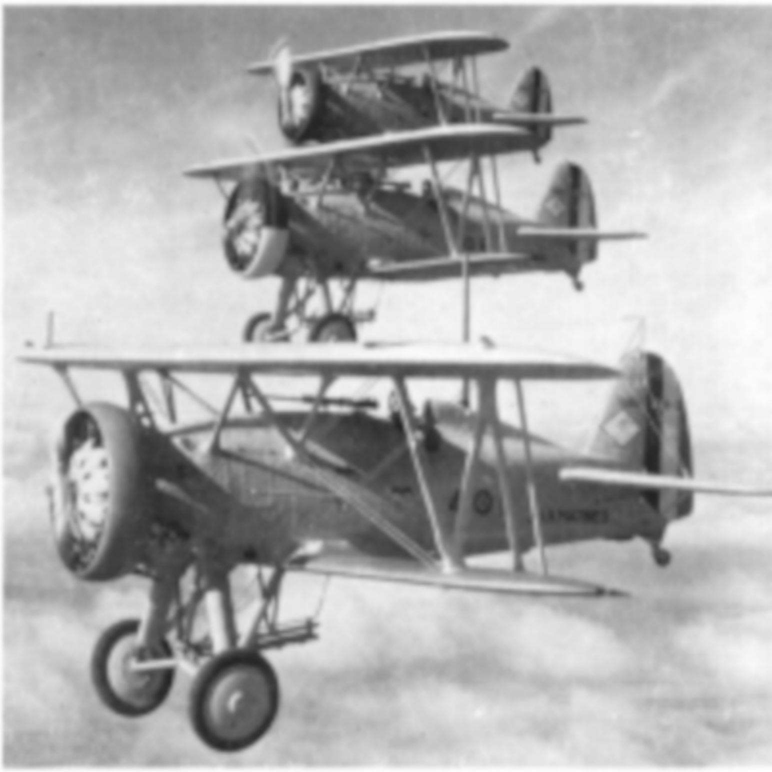


Left: *Major production model of FB series was FB-5, Boeing Model 67, which could be operated as a landplane or a twin-float seaplane.* Right: *F2B-1, Boeing Model 69, was improved PW-9/FB-5 designed for P&W Wasp radial engine.* (Photos: U.S. Navy)

Left: *XF3B-1, Boeing Model 74, resembled earlier F2B-1 and could operate as landplane or single-float seaplane. "American Flag" rudder stripes were developed by Boeing and adapted by U.S. Army in November 1926.* (Photo: U.S. Navy). Right: *Production F3B-1, Boeing Model 77, bore little resemblance to XF3B-1 prototype. It was fitted with engine drag ring several years after delivery.* (Photo: P. M. Bowers)






Three F4B-3s (8891, 8898, 8803) of VB-4M U.S. Marines, San Diego, California. (Photo: U.S. Navy)

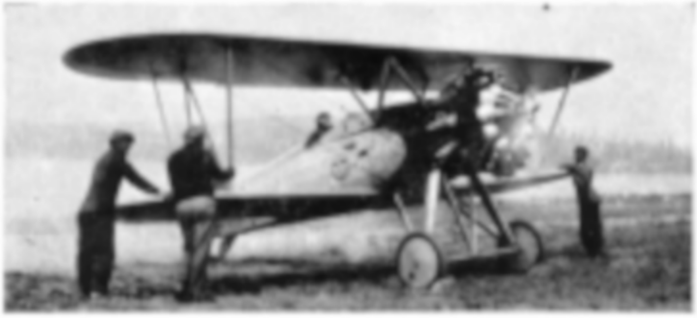
engine of 450 h.p. This engine was unsuccessful and the Navy replaced it with the newer 450 h.p. Pratt & Whitney Wasp radial and redesignated the aircraft FB-6. The major production model of the Navy FB series was the FB-5, an improvement of the Packard-powered FB-3 in which the wings were heavily staggered in the manner of the Curtiss "Hawk". Twenty-seven were built with serials *A-7101* to *A-7127*. Several sets of Boeing-built wooden pontoons were delivered with the FB-5s and some of them were operated as twin-float seaplanes. Army PW-9 production eventually totalled 113 and 43 FBs were delivered to the Navy.

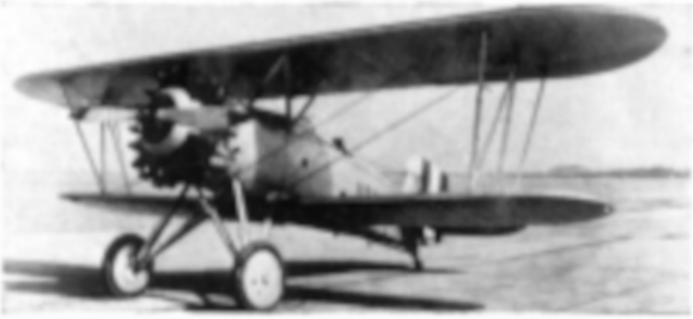
The success of the new Wasp engine in the FB-6 opened up a whole new field of Navy fighter development, and Boeing went to work on another design, the Model 69—essentially a refined PW-9/FB fitted with the new engine. One prototype XF2B-1 (*A-7385*) was delivered to the Navy in December 1926 and was followed by 32 production F2B-1s (*A-7424* to *A-7455*) starting in January 1928 (the number 2 preceding the B-for-Boeing in the designation indicated the second fighter model ordered from Boeing).

Even before the F2B-1s were in production, Boeing submitted an improved version to the Navy. This was the company-owned Model 74, a machine that resembled the F2B-1 but was tested by the Navy as XF3B-1; it did not win production orders in its original form. Extensively rebuilt as Model 77 and tested again in the spring of 1928, it won an order for 73 F3B-1s (*A-7675* to *A-7691* and *A-7708* to *A-7763*) that were delivered between August and December 1928. The company-owned prototype, brought up to production standard, was bought by the Navy and became an additional item on the contract (as *A-7674*). The F3B-1s had provisions for the installation of a single main pontoon and wing-tip floats, but the Navy lost interest in seaplane fighters at this time and flew the F3Bs on wheels only.

F4B DEVELOPMENT

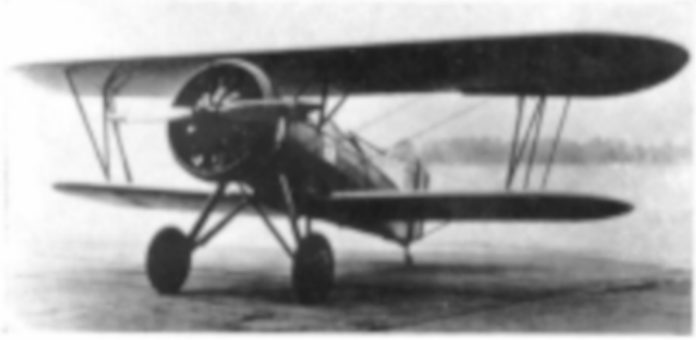
Even as the modified XF3B-1 was being tested, Boeing saw opportunities for improvement; design of an entirely new model was laid down and the building of two company-financed prototypes was authorised. The two differed only in minor details of equipment but were given distinct Boeing model designations, 83 and 89; external differences between them were the use of cross-axle undercarriage and arrester hook on the 83, and tripod-type wheel gear and 500-lb. bomb-rack on the 89. The chief merit of the new design was the fact that there was nothing radical about it. Every feature had been developed and proven on previous models—including even the unique bolted aluminium fuselage frame which was made up of square-section aluminium tubing. The customary practice of installing a larger engine in a new model to increase the performance was not necessary as the performance

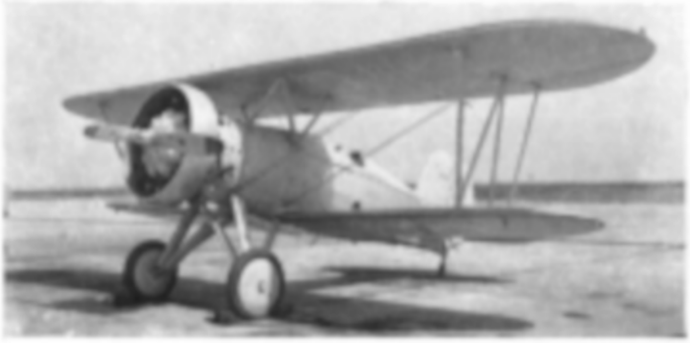


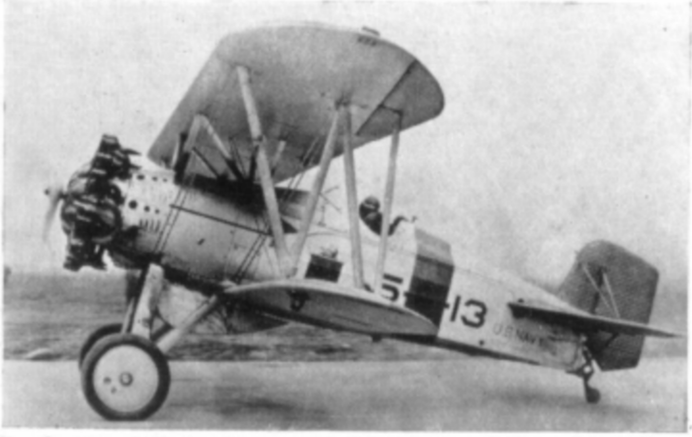


Left: *Boeing Model 89, the first XF4B-1 prototype, in company colours during early tests at Sand Point Naval Air Station, Seattle.* (Photo: Mike Pavone.) Right: *Model 83 modified at the factory and brought up to F4B-1 standard. Was delivered on the production F4B-1 contract.*

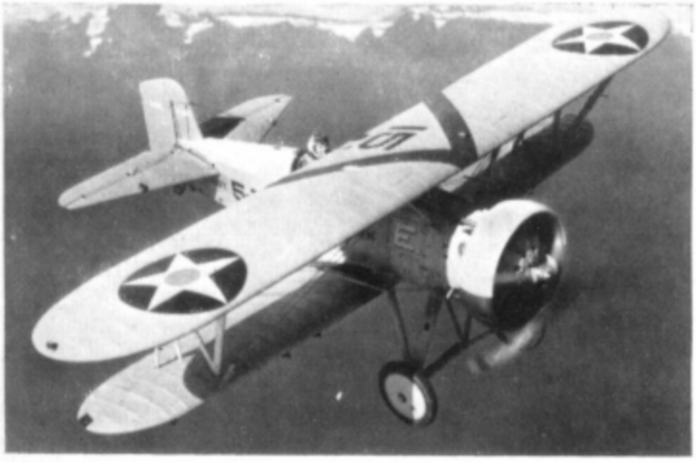
Left: *Fourth production F4B-1 was converted to special unarmed executive model for Assistant Secretary of Navy for Sir Douglas Ingalls, under designation of F4B-1A.* (Photo: U.S. Navy.) Right: *In their declining years F4B-1s were fitted with 4B-2 ring cowlings and 4B4 vertical tail surfaces.* (Photo: E. M. Sommerich)







Production F4B-1, Boeing Model 99, as delivered to Navy squadron VF-5. Engine cylinder streamline fairings of original installation deleted after short period of service.
(A. U. Schmidt Collection)



F4B-2, Boeing Model 223, was similar to Army P-12C and D Models. It differed from F4B-1 in aileron shape, undercarriage and use of engine cowling.

advance of the new design was achieved mainly through aerodynamic refinement and decreased structural weight. A speed increase of 21·5 m.p.h. over the F3B-1 was obtained with an increased output of only 50 h.p. from the later model Wasp engine. Climb was 900 ft./min. greater than that of the F3B-1 and the absolute ceiling 7,300 feet higher. The Model 83 was 398 pounds lighter.

Both prototypes were tested by the Navy in the summer of 1928, one at various naval bases on the West Coast and the other at the naval test centres at Anacostia, Maryland, and Hampton Roads, Virginia, on the East Coast. Although both were still Boeing-owned aeroplanes with civil registrations *7133* and *7134*, they were designated XF4B-1 during Navy tests. In an unprecedented move, the Navy allowed public demonstration of one XF4B-1 (Model 83) at the 1928 National Air Races at Los Angeles. The potentialities of the new design were demonstrated by speed dashes and by the setting up of a new time-to-height record. Reversing the earlier PW-9/FB-1 situation, the Army borrowed the Model 89 from the Navy for evaluation and placed an order for 10 similar models under the Army designation P-12 (*Profile* No. 2). Army P-12 production eventually totalled 366.

An order for 27 F4B-1 fighter-bombers (*A-8130* to *A-8156*) resulted from the Navy-testing of the two prototypes. Both XF4B-1s were re-worked to production F4B-1 standard (Boeing Model 99, which used the Model 89 undercarriage) and were purchased by the Navy as additional items on the F4B-1 contract (*A-8128* for the 89 and *A-8129* for the 83). The experimental prefix was deleted at this time and both machines were considered as standard F4B-1s although minor differences were noticeable.

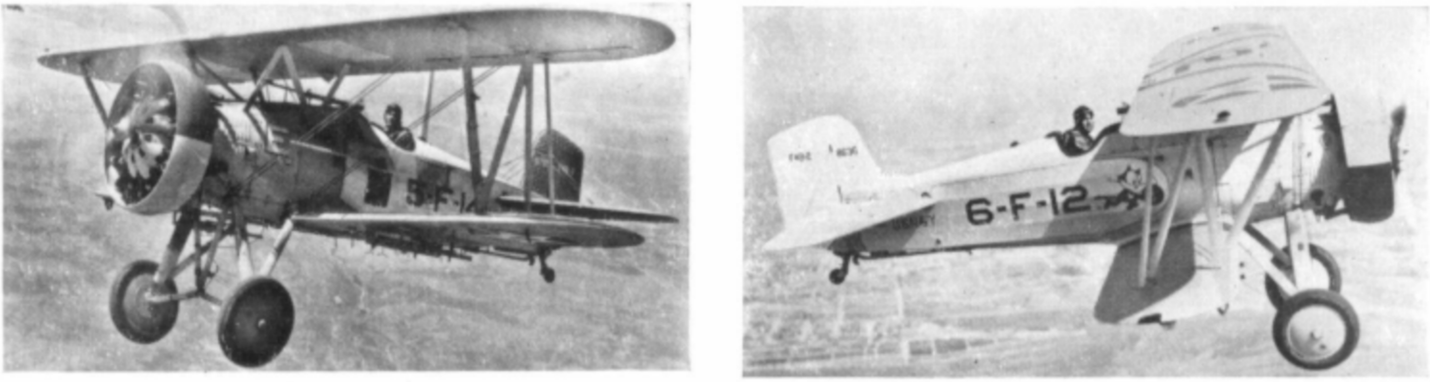
The development of the new design continued along parallel lines for the U.S. Army and Navy. The next Navy order was for 46 F4B-2s (Boeing Model 223), generally similar to the Army P-12C and D Models. Navy serials were *A-8613* to *A-8639* and *A-8791* to *A-8809*. External differences between the F4B-2 and the -1 were in the use of straight-chord Frise ailerons, balanced elevators, reversion to the cross-axle undercarriage of the Model 83, and use of a Townend anti-drag ring round the engine.

THE F4B-3/4 PROTOTYPE

With production orders for P-12s and F4Bs in hand, Boeing continued its practice of developing advanced models. Two monoplane fighters of 1930, the Model 202 tested by the Army as the XP-15 and the duplicate Model 205 eventually purchased by the Navy as the XF5B-1, were not notably successful. Both were essentially F4B/P-12 designs built as parasol monoplanes and as such were somewhat ahead of their time. Both, however, featured a new semi-monocoque sheet aluminium fuselage construction which had been introduced in the commercial Boeing Model 200 "monomail". The same construction was then tried in a more conventional Boeing biplane, the Model 218, which was virtually a P-12B with the new fuselage. Both the Army and Navy tested the Model 218 in 1930 and 1931 and placed production orders. Strangely, the major structural change, which was great enough to justify an entirely new model number, did not have this result. The following Navy models were the F4B-3 and -4, and the Army P-12E and F models. The Model 218 itself was sold to China and was destroyed when attacking superior numbers of Japanese aircraft over Shanghai in 1932.

In spite of minor structural improvements, notably the enlarged fin and higher load-factored wings on the F4B-4, both the F4B-3 and the F4B-4 used the same Boeing Model number of 235. The first 54 -4s were

Air shots of F4B-2s show how undercarriage wheels drop in flight. Right illustration is of 8638 (VF-6B) of Fighting Squadron 6, 3rd aircraft of 4th Section.
(Photo: F. C. Dickey, Jnr.)



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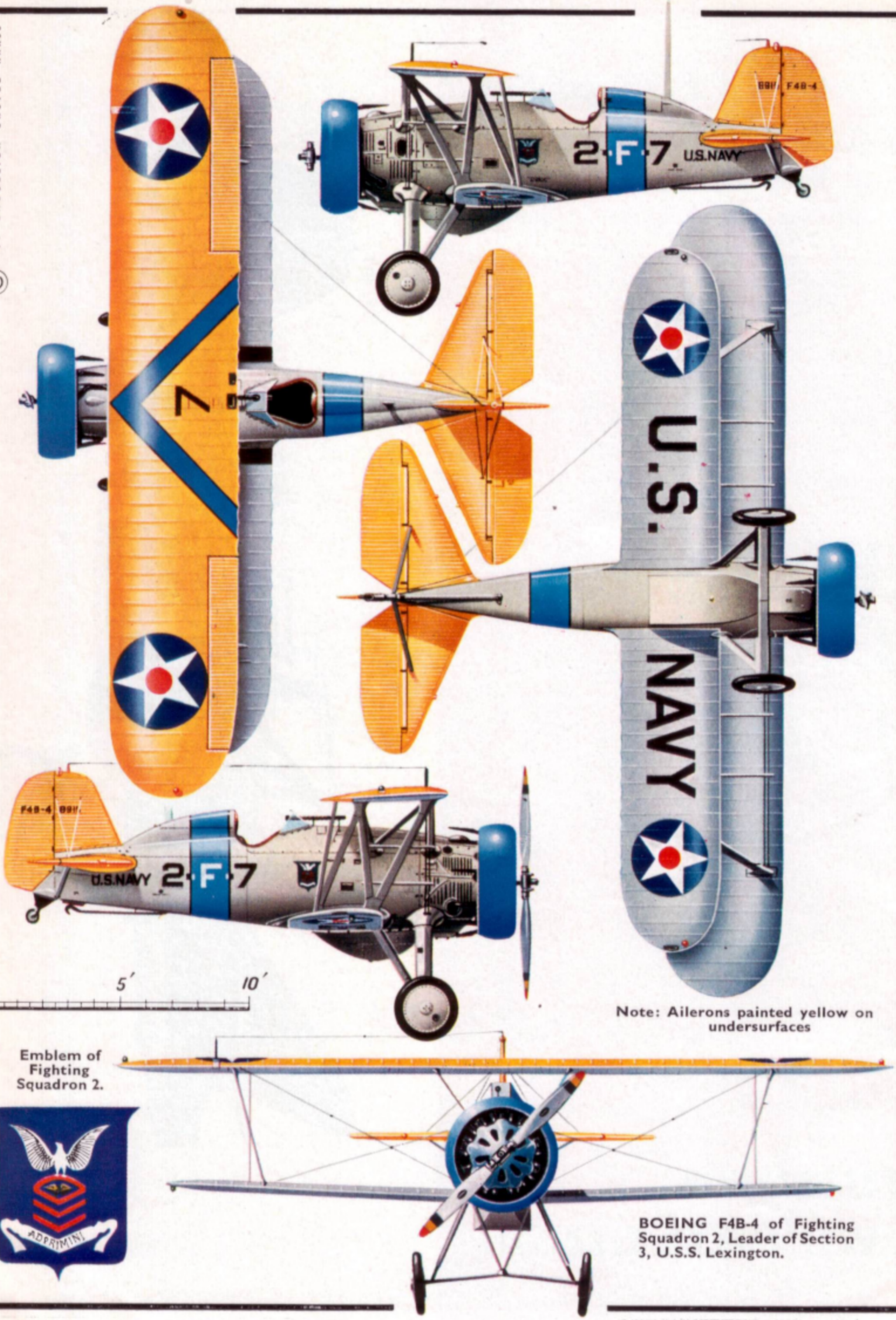
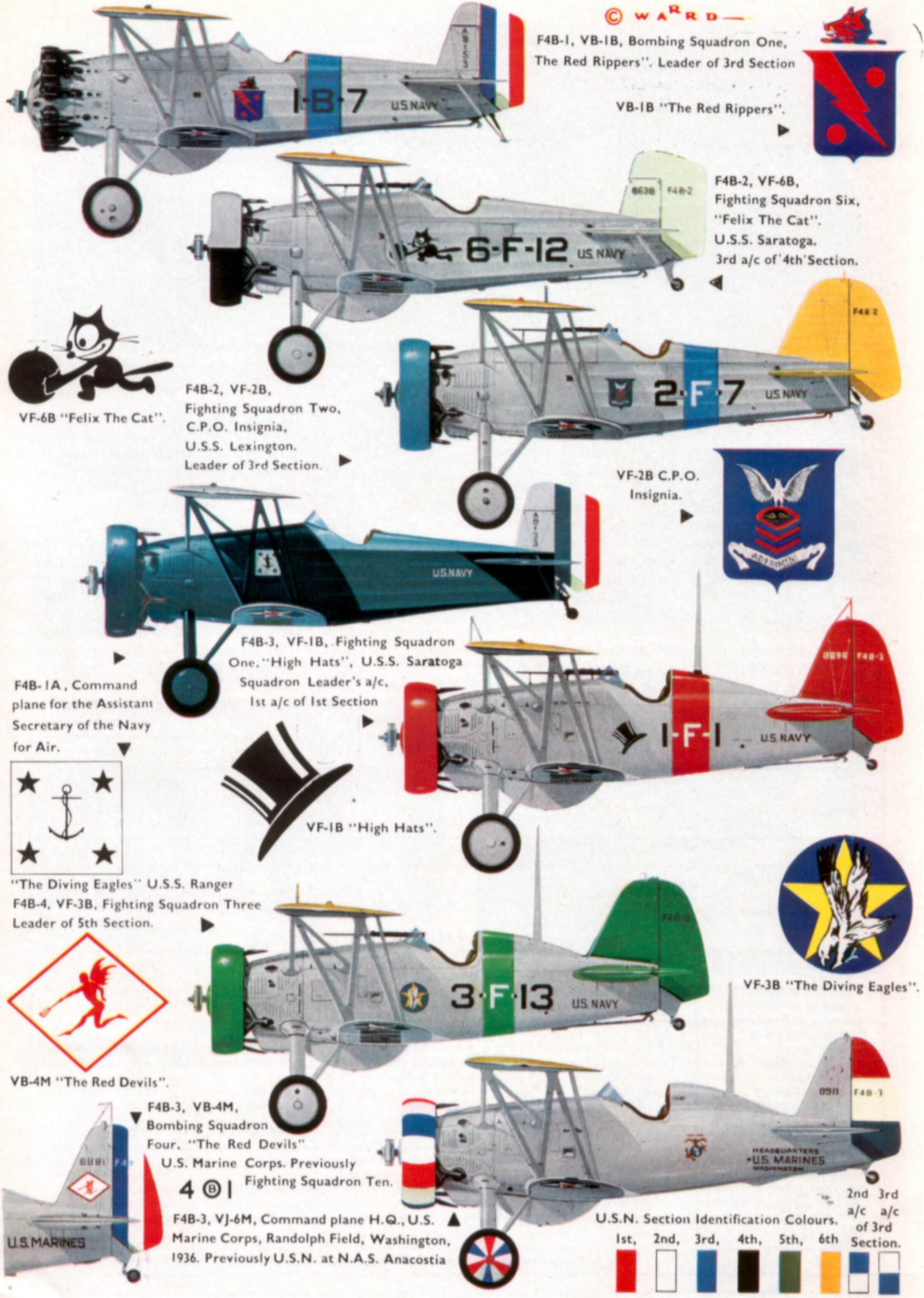

7
2-F-7
U.S.NAVY
8911 F4B-4
F4B-4 8911
U.S. NAVY
5′
10′

Note: Ailerons painted yellow on undersurfaces

Emblem of Fighting Squadron 2.

ADPRIMINI

BOEING F4B-4 of Fighting Squadron 2, Leader of Section 3, U.S.S. Lexington.


A8153
1-B-7
U.S.NAVY
8638
F4B-2
6-F-12
US NAVY
F4B-2
2-F-7
US NAVY
A8133
US NAVY
8896
F4B-3
1-F-1
US NAVY
F4B-3
3-F-13
US NAVY
8891
U.S.MARINES
8911
F4B-3
HEADQUARTERS
U.S. MARINES
WASHINGTON

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F4B-1, VB-1B, Bombing Squadron One, The Red Rippers". Leader of 3rd Section

VB-1B "The Red Rippers".

F4B-2, VF-6B,
Fighting Squadron Six,
"Felix The Cat".
U.S.S. Saratoga.
3rd a/c of 4th Section.

VF-6B "Felix The Cat".

F4B-2, VF-2B,
Fighting Squadron Two,
C.P.O. Insignia,
U.S.S. Lexington.
Leader of 3rd Section.

VF-2B C.P.O.
Insignia.

F4B-1A, Command plane for the Assistant Secretary of the Navy for Air.

F4B-3, VF-1B, Fighting Squadron One, "High Hats", U.S.S. Saratoga
Squadron Leader's a/c,
1st a/c of 1st Section

VF-1B "High Hats".

"The Diving Eagles" U.S.S. Ranger
F4B-4, VF-3B, Fighting Squadron Three
Leader of 5th Section.

VF-3B "The Diving Eagles".

VB-4M "The Red Devils".

F4B-3, VB-4M,
Bombing Squadron
Four, "The Red Devils"
U.S. Marine Corps. Previously
Fighting Squadron Ten.

4 Ⓑ 1

F4B-3, VJ-6M, Command plane H.Q., U.S.
Marine Corps, Randolph Field, Washington,
1936. Previously U.S.N. at N.A.S. Anacostia

U.S.N. Section Identification Colours.

1st,	2nd,	3rd,	4th,	5th,	6th	2nd a/c of 3rd Section.	3rd a/c of 3rd Section.
🟥	⬜	🟦	⬛	🟩	🟨	🟦 ⬜	⬜ 🟦

additional items on the F4B-3 contract with continuing serial numbers, and were originally to have been -3s. The almost identical Army P-12E was Model 234 and the P-12F was Model 251. The 21 F4B-3s carried Navy serials *A-8891* to *A-8911*.

The 92 production F4B-4s were delivered under two contracts. The first for 75 aircraft, 21 of which were delivered as F4B-3, was signed on 23rd April 1931. Serials of the first 54 F4B-4s were *A-8912* to *A-8920* and *A-9009* to *A-9053*. The last 38 were *9226* to *9263*, the A-prefix having been discarded by the Navy after passing *A-9206* in 1932. One additional F4B-4, *9719*, was built from spare parts stored at the U.S. Marine Corps base at Quantico, Virginia. In another unprecedented move, the Navy allowed 14 random machines from the first order to be diverted to Brazil—the first time that a first-line U.S. military aircraft was released for export before deliveries began to U.S. forces. The Brazilian models were designated Model 256 by the Boeing Engineering Department but were referred to as "1932" by the Sales Department to identify them as the current export model. The Brazilian aircraft did not reduce the size of the Navy order as Boeing was allowed to build 14 replacement machines as part of the second F4B-4 contract, which was originally for 38 machines.

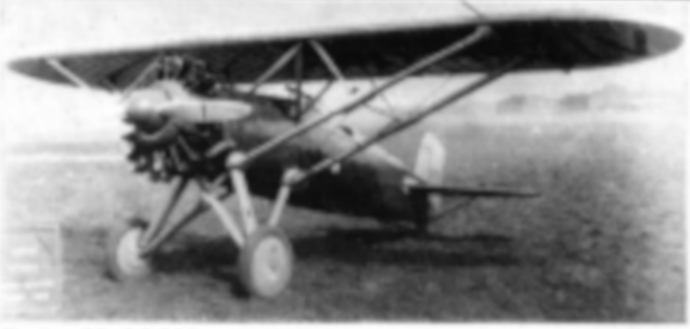
The first F4B-4 was delivered on 21st July 1932, and the last on 28th February 1933. Seventy-one were delivered to the U.S. Navy and 21 to the Marine Corps. The Brazilian 256s were all delivered between 14th September and 8th October 1932. A follow-on order for nine Model 267s, also for Brazil, was delivered in a block on 21st February 1933, a week before the final F4B-4 delivery. The 267 was a combination aircraft using P-12E wings on the F4B-3 fuselage, tail and undercarriage. In 1940, 23 obsolete P-12s of various series (but mostly P-12Es) were obtained from the Army and redesignated F4B-4A. Serials were *2489* to *2511* in the second Navy serial number range.

STRUCTURE

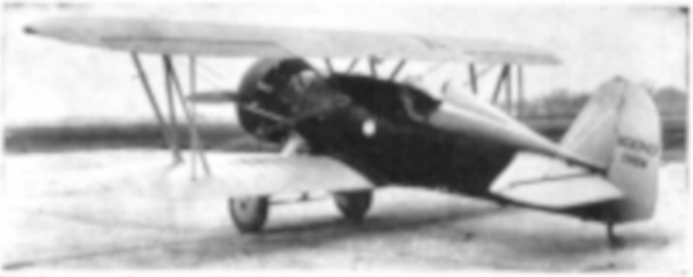
Except for the fuselage, which duplicated that of the Model 218, the structure of the F4B-3 and -4 was similar to that of the Model 83/89 prototypes. The one-piece upper wing used two full-span box spars with wing ribs cut from mahogany plywood and spruce cap strips and diagonal trusses nailed and glued in place; lightening holes were cut with a jig-saw. The wing-tip bows were laminated wood and the trailing edges were wire, which produced a scalloped effect—reminiscent of World War I days—when dope was applied to the fabric. The lower wing was similar in structural detail to the upper but was built in two separate pieces which were bolted together prior to assembly of the aircraft to form a single unit.

Metal ailerons, covered with corrugated sheet aluminium, were fitted to the upper wings only and were operated by push rods from actuating mechanism carried in the lower wing. Two flotation bags, inflated by bottled carbon dioxide, were carried in the upper wing just outboard of the centre-section struts. To allow their deployment from the under surface of the wing, the landing wires were lowered from their usual terminal points at the upper ends of the centre-section struts and attached to the upper longerons. This arrangement had been introduced on the F2B-1.

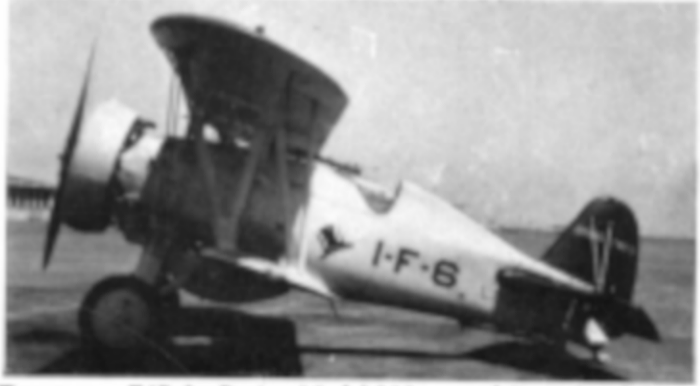
Construction of the tail surfaces was the same as that of the prototypes but had the revised vertical tail shape used on the P-12E and F4B-3 after modification



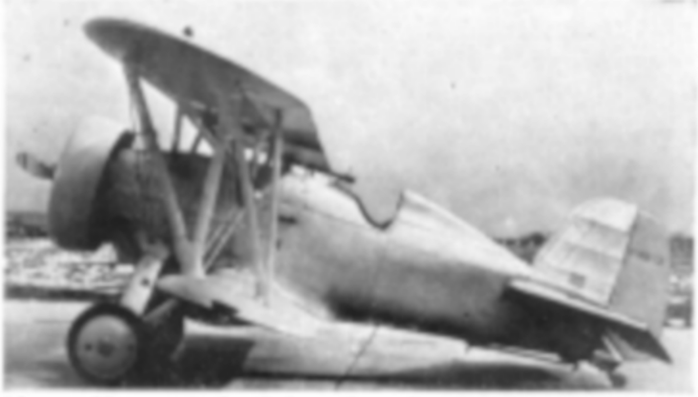
Boeing Model 205, essentially a monoplane version of P-12/F4B, was sold to Navy as XF5B-1. Its semi-monocoque fuselage construction re-appeared on Model 218 and on later production versions of P-12/F4B. (Photo: U.S. Navy)



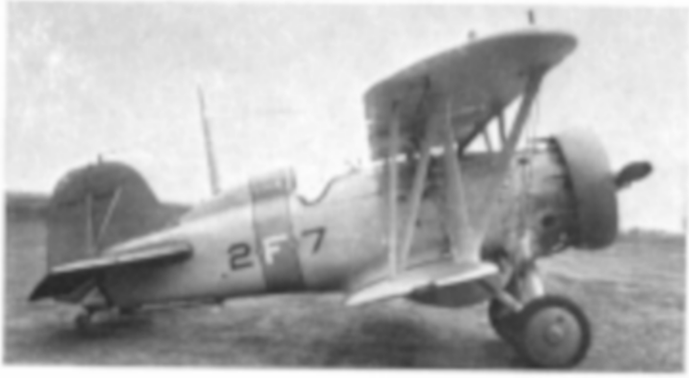
With revised vertical tail shape, the modified Model 218 became prototype of Army P-12E and F, Navy F4B-3 and 4. (Photo: U.S.A.F.)



Twenty-one F4B-3s, Boeing Model 235, were delivered to fighter-bomber Squadron VF-3B, serving aboard carrier U.S.S. Saratoga in 1932–33. (A. U. Schmidt Collection)



Above: *New vertical tail shape for still unbuilt F4B-4 was tested with this tube-and-fabric structure installed on a standard F4B-3.* (Photo: U.S. Navy). Below: *F4B-4 of VF-2 Squadron with yellow tail. Blue band around fuselage of No. 7 a/c identified leader of third, three-plane element in squadron.* (E. M. Sommerich Collection)



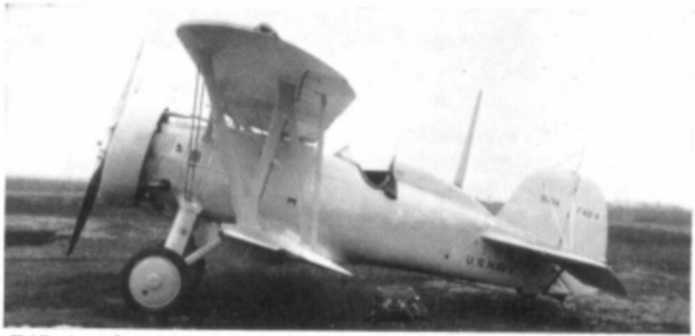
of the Model 218. The enlarged vertical fin of the F4B-4 provided relatively little improvement in directional stability over the F4B-3 but was considered so superior to earlier versions that the F4B-4 fin and rudder were ordered to be incorporated in F4B-1s and -2s then in service. Adjustment of longitudinal trim was effected by rotating the leading edge of the tailplane up and down by means of a jackscrew.

The forward portion of the fuselage was a composite structure, steel tube joining the tubular engine mounting to the stamped metal bulkheads and sheet aluminium covering skin. The cockpit cut-out was fairly large to permit pilot access in full flying gear, but draughtiness in flight was reduced by side curtains that could be drawn up to reduce the size of the opening. The 55-gallon fuel tank was located between the pilot and the engine, and the standard armament of two ·30-cal. machine guns or one ·30-cal. and one ·50-cal. gun were installed in deep channels forward of the pilot and above the tank. Ammunition was fed to the guns by belts folded into individual boxes below the guns. A telescopic gunsight passed through the windscreen.

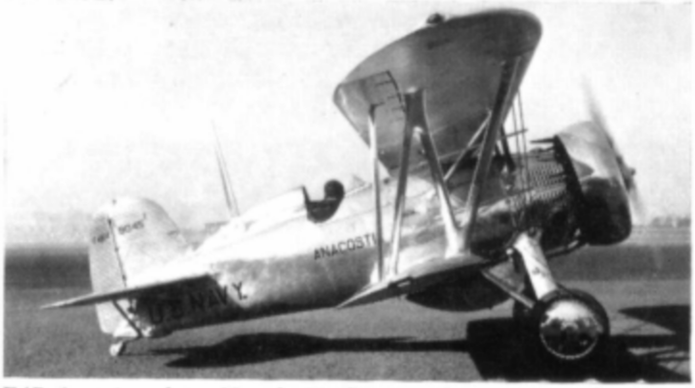
Bombload consisted of a single 116-lb. bomb on a rack under each lower wing. Although the F4B-1s had on occasion been fitted with a single 500-lb. bomb under the fuselage, this position was generally used for the carriage of a 50-gallon auxiliary tank on Army P-12s and Navy F4Bs.

The spreader-bar undercarriage used solid-disc metal wheels with 30 × 5-in. tyres and the steerable tailwheel used a solid rubber type of 6-in. diameter. The standard deck-landing arrester hook was installed in the rear fuselage forward of the tailwheel.

The 52 F4B-4s on the second contract had more comprehensive radio, improved engine exhaust manifolds and additional night lighting. The earlier machines were later equipped to the same standard. The last 45 F4B-4s were built with removable engine mountings and enlarged headrests for storage of a pilot's life raft.

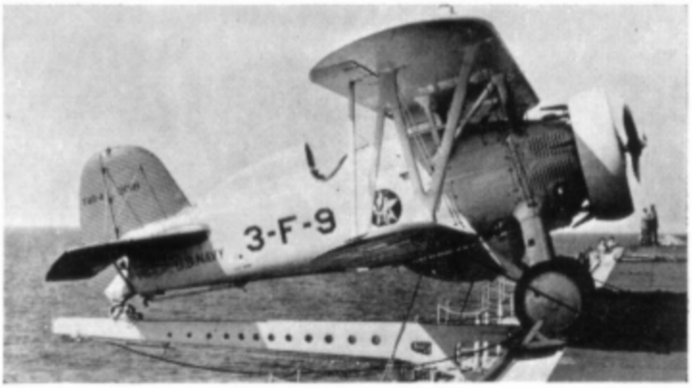


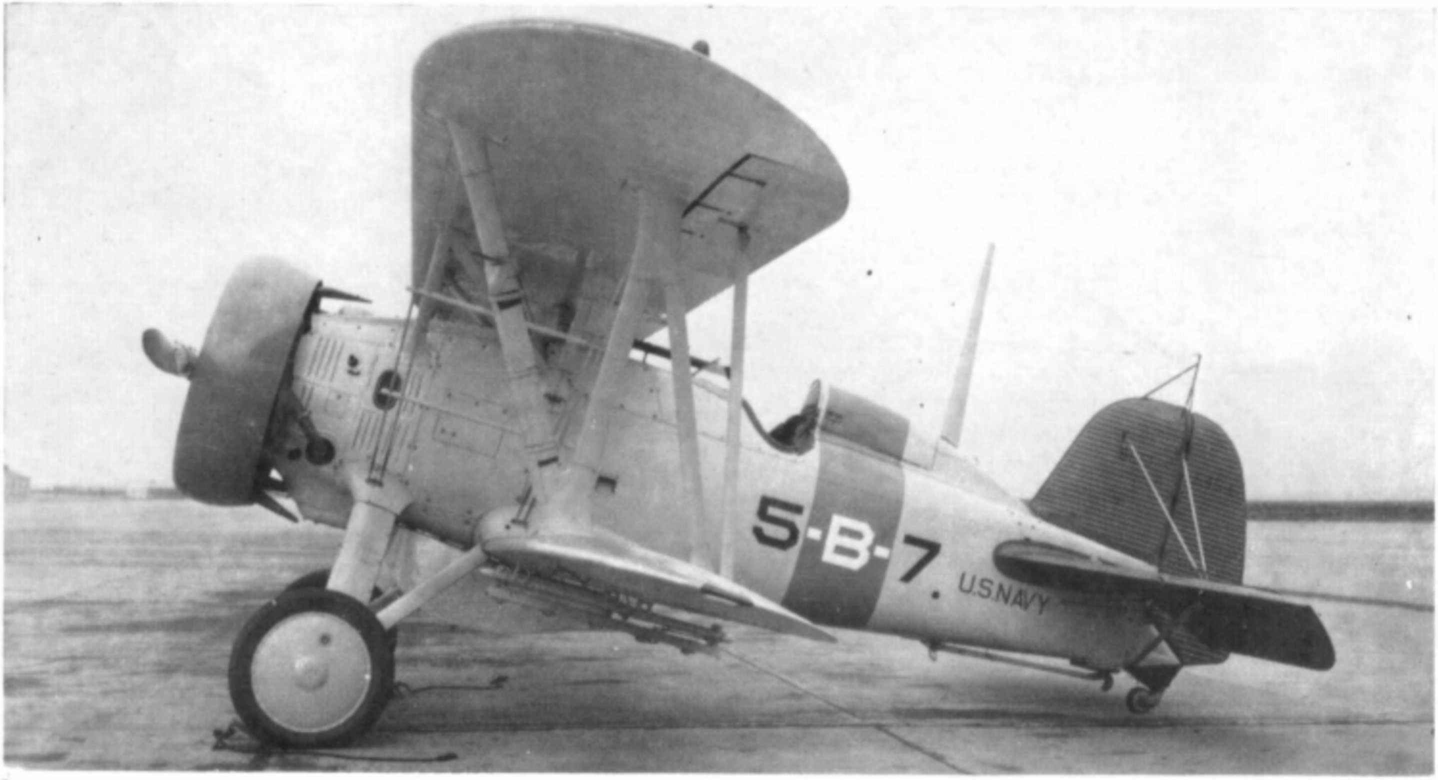
F4B-4 without service markings. All metal parts light grey, fabric areas silver except upper wing surface.
(E. M. Sommerich Collection)



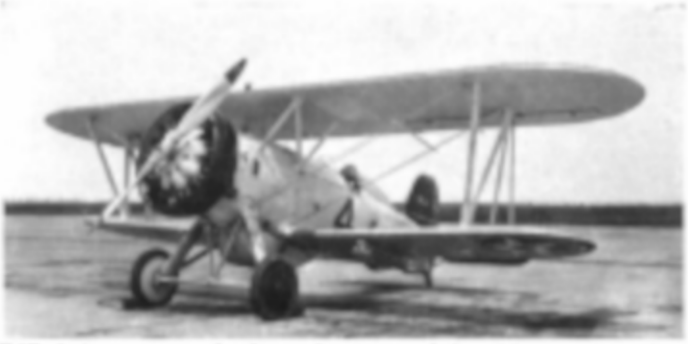
F4B-4 assigned to Naval Air Station Anacostia, with special polished Alclad finish used only at that station.
(Photo: P. M. Bowers)

Below: *Unusual shipboard stowage of green-tail F4B-4 of VF-3 aboard* U.S.S. Ranger. *Tails are run out along booms projecting overside to conserve deck space.* (Photo: U.S. Navy)

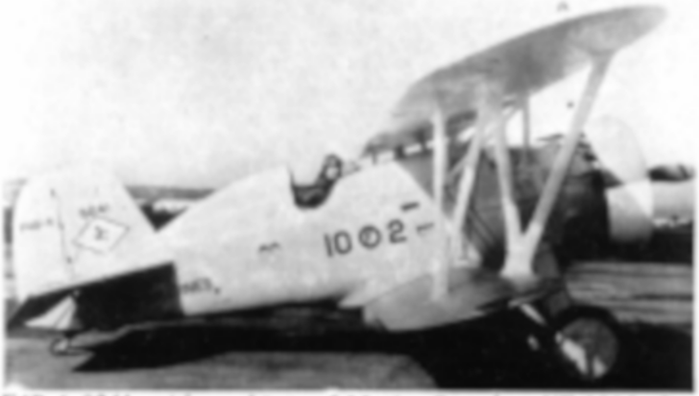




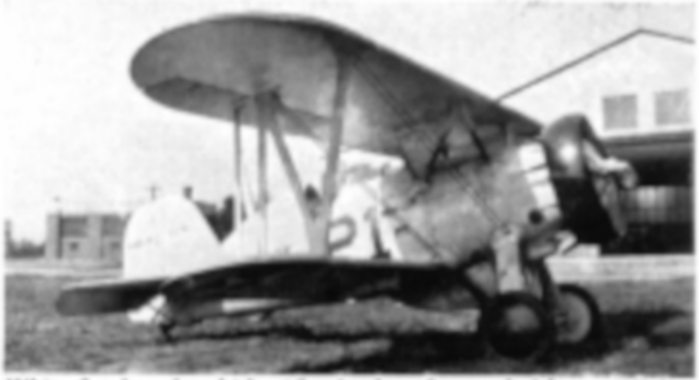
Some F4B-4s were assigned to bombing squadrons, as was this green-tailed member of Squadron VB-5. (Photo: P. M. Bowers)



F4B-4 in non-standard markings used by Marine Squadron VF-9M from 1933 through 1938. (Photo: P. M. Bowers)



F4B-4, 9241, *with markings of Marine Squadron VF-10M after deletion of standard Marine Corps vertical tail stripes. Coloured top half of cowling indicates No. 2 a/c in three-plane element.* (Photo: U.S. Navy). Below: *Same a/c following transfer VF-9M in the non-standard markings peculiar to that squadron.* (E. M. Sommerich Collection)



COLOUR SCHEMES

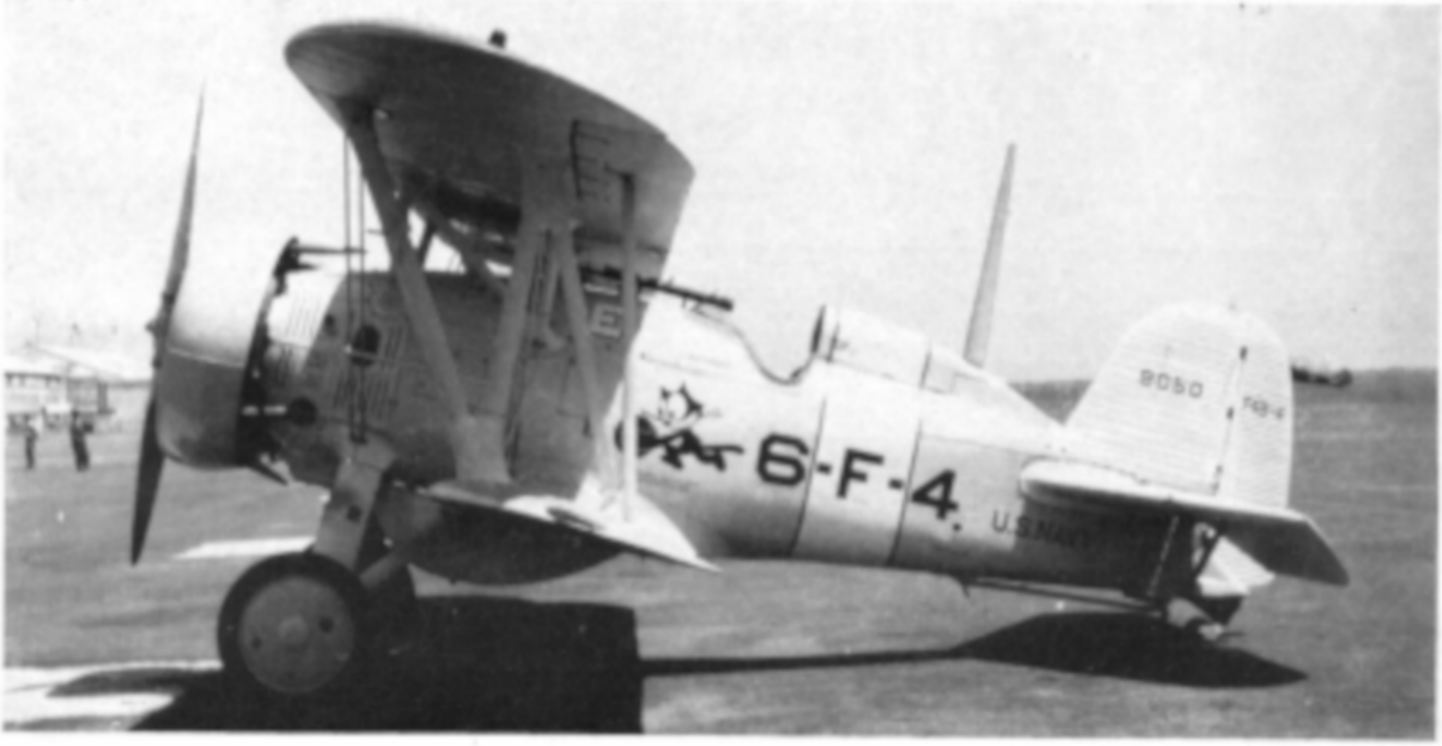
Standard U.S. Navy colour schemes underwent a slight change just at the time the F4B-3 appeared. Silver for fabric areas and chrome or orange-yellow for the upper wing surface remained the same, but the light grey previously used for metal components (seen on the F4B-2) was made even lighter, and the all-metal fuselages of the F4B-3s and -4s were practically an off-white shade. The F4B-1s were the last Boeing navy fighters to use the vertical red, white and blue tail stripes, and even then use was divided with the solid tail colour that identified aircraft of a particular squadron (station or aircraft carrier after 1936). All F4B-3s and -4s of the U.S. Marine Corps, however, continued to use the striped rudders with the exception of Squadron VF-9M at Quantico, Virginia, which used non-standard markings from 1933 until 1938, including solid-colour tails of red, white and blue for various flights within the Squadron.

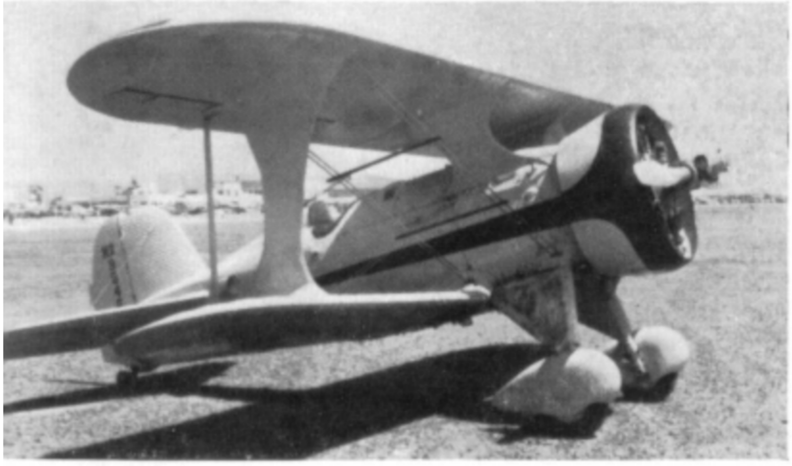
The lettering U.S. NAVY, often but incorrectly assumed to appear below the lower wing of the F4B-4, was not in fact used on F4B-4s, and only briefly on F4B-3s, having been discontinued in May 1932. Marine Corps aircraft carried the lettering U.S. MARINES across the upper surface of the top wing until 1936. Prior to 1936, the Marines did not use the Navy system of a coloured band around the fuselage to identify section leaders' aircraft (six to a squadron), and distinguished their machines from equivalent Navy models until 1936 by painting a circle round the squadron designator letter on the fuselage (the F in 10-F-2). Since the Marine Corps emblem was carried on the fuselage where the Navy squadron insignia normally appeared, the squadron insignia of Marine aircraft, when used, was painted on the fin.

SERVICE RECORD

The F4B-4s entered service with the Navy and Marines in mid-1932 and served as first-line equipment with seven squadrons until replaced by Grumman F2F and F3F biplanes in 1937–8. A study of photographs showing squadron markings would tend

White fuselage band identifies leader of second element. "Felix the Cat", with bomb, was insignia of VF-6 when it flew from U.S.S. Saratoga *from 1932 through 1936. Squadron was re-organised in 1937 and flew from* U.S.S. Enterprise *with blue tails and Comet insignia.* (Photo: Art Whitmer)





F4B-4, 9251, *as modified for air show work after W.W.II.*
(Photo: P. M. Bowers)

to indicate a higher total of ten squadrons, but this was explained by the redesignation of existing units.

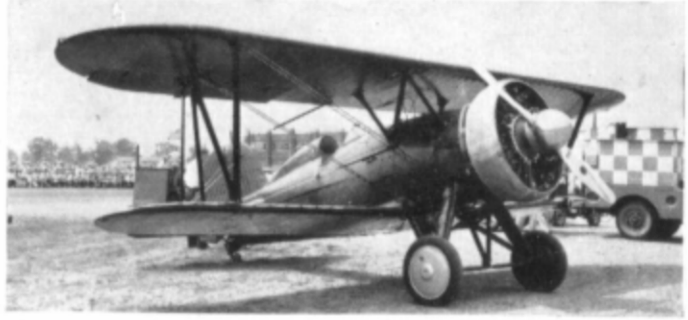
While not the last biplane fighters in U.S. Naval service, the F4B-4s were the last with fixed landing gear and as such marked the end of an era. Following their withdrawal from the Fleet, the F4Bs of all marks were assigned to training schools, utility duties, general transport of VIPs, etc. The appearance of F4B-4s with standard U.S. Navy camouflage in the background of photographs of other naval aircraft indicates that a few regained fighter status for a short time early in 1942. With most first-line fighters at sea with the Fleet after Pearl Harbour, some obsolete models were impressed for home defence. The ultimate fate of the F4Bs on hand in 1941–2 was to be shot down as unmanned aerial targets, being flown under radio control from ground stations or director aircraft to provide gunnery practice for anti-aircraft batteries.

CIVILIAN F4B-4s

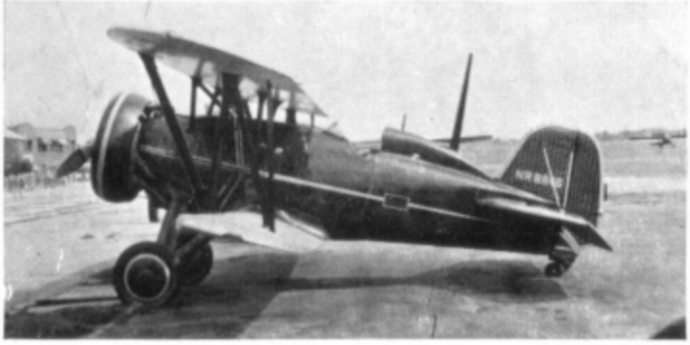
By chance two F4B-4s survived World War II in civilian status. In 1940 the Marine Corps turned two F4B-4s (*9241* and *9251*) over to the Bureau of Air Commerce, predecessor of the present Federal Aviation Agency (FAA). These were given the civil registrations *NC-14* and *-13* respectively, and were issued Category 2 type Certificate No. 2–555. After a short period of civil service use, both were declared surplus and sold to Mr. Jesse Bristow, a well-known American exhibition pilot. He retained the latter, *9251*, and sold *9241*.

Both machines were given new civil registrations, *9241* (*NC-14*) becoming *NR-9329* (later *NX-9329*), and *9251* (*NC-13*) becoming *NR-9486*.

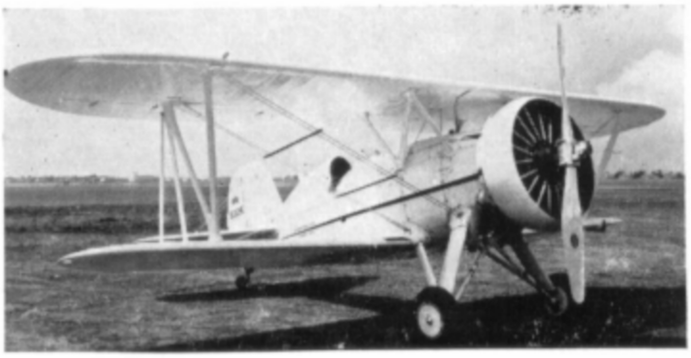
Mr. Bristow modified *NR-9846* for a new air show routine. The standard N-struts were modified to I-type, a different undercarriage was fitted and a late-series 600-h.p. P. & W. R-1340-AN-1 Wasp engine with



Above: *F4B-4s* 9241 *and* 9251 *were turned over to Bureau of Air Commerce in 1940 and given civil licences NC-14 and 13 respectively.*
(Photos: P. M. Bowers)

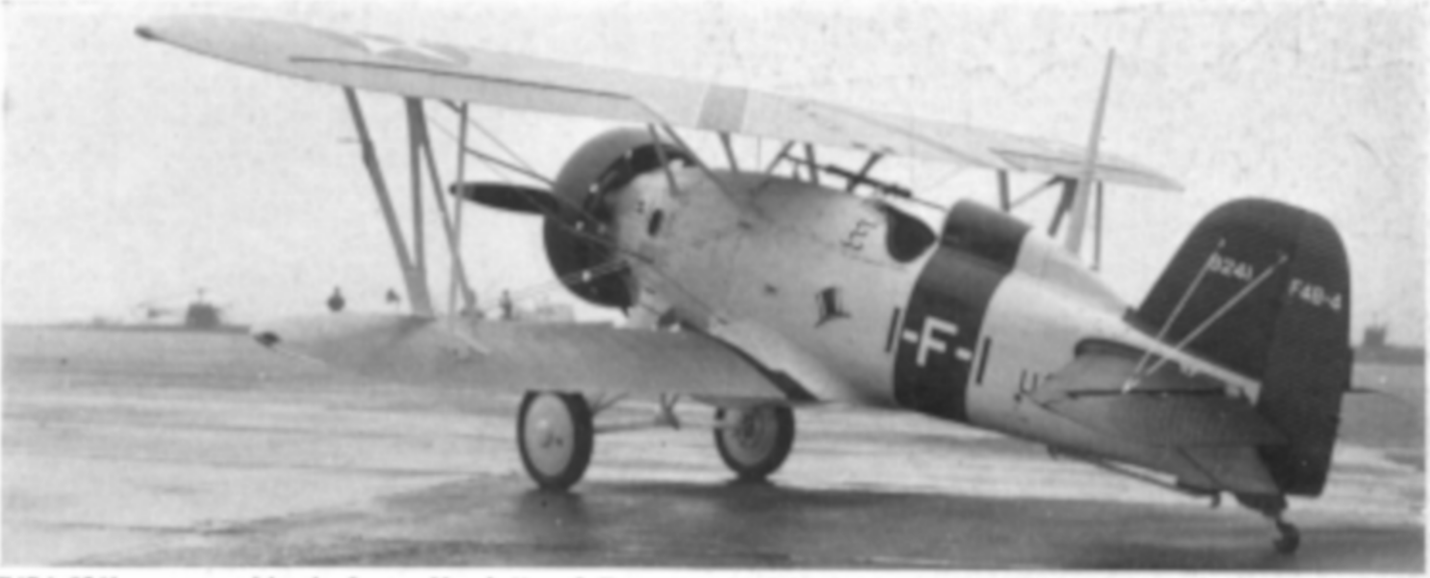


F4B-4, 9241, *as used for air show work just prior to W.W.II.*
(Photo: C. Schuler)



F4B-4 SQUADRON ASSIGNMENTS, 1932–8

Squadron	Dates	Carrier or Station	Tail Colour
VB–5 VB–5 as VB–2	Nov. 1934 to June 1935 Nov. 1935 to June 1937 July 1937 to Nov. 1937	U.S.S. *Ranger* U.S.S. *Lexington* U.S.S. *Lexington*	Willow Green Willow Green Lemon Yellow
VF–2	Nov. 1934 to June 1935	U.S.S. *Lexington*	Lemon Yellow
VF–6	Oct. 1932 to June 1936	U.S.S. *Saratoga*	White
VF–3 VF–3	Oct. 1932 to June 1934 Nov. 1934 to June 1935	U.S.S. *Langley* U.S.S. *Ranger*	Willow Green Willow Green
VF–1 as VF–8 as VF–6	Apr. 1935 to June 1936 June 1937 June 1937 to Nov. 1937	U.S.S. *Langley* U.S.S. *Enterprise* U.S.S. *Enterprise*	Royal Red True Blue True Blue
VF–10M to VB–4M	July 1932 to 1933 1933 to 1935	San Diego, Calif. San Diego, Calif.	USMC Tail Stripes USMC Tail Stripes
VF–9M	1932 to 1938	Quantico, Virginia	Stripes to 1934; Special solid colours to 1938



F4B4, 9241, as restored by the former Naval Aircraft Factory in April 1961. This a/c served only with the Marine Corps and has since been repainted in the markings it carried in VF-9M. (Photo: Shipp)

controllable-pitch propeller was installed. A full NACA cowling was added to the engine and fittings were installed under the fuselage for two 300-lb. thrust JATO bottles. With the increased engine power and the rocket thrust, Mr. Bristow was able to make spectacular straight-up take-offs after a phenomenally short run. This unique exhibition variant was destroyed in 1948 soon after acquisition by a new owner.

The other civil F4B-4, registered *N-9329* after 1948, saw varied service for a few years (including crop dusting), and in 1960 was donated to the National Air Museum of the Smithsonian Institution by its final owner, Mr. Ray Hyland.

The Smithsonian prevailed upon the former U.S. Naval Aircraft factory in Philadelphia to restore it to a displayable, though non-flying, condition. This work was completed in time for the machine to be exhibited on Armed Forces day of 1961, the 50th anniversary year of U.S. Navy aviation. Unfortunately the markings selected for the restoration during the last-minute rush were copied from a proprietary plastic model kit and were of a combination that had never appeared on an F4B-4 but which had been seen on an F4B-3. Since its initial appearance as a restored fighter, this F4B-4 has been repainted in the actual colours and markings that it carried when assigned to Marine Corps Squadron VF-9M at Quantico, Virginia, from 1933 to 1938. Pending permanent installation in the new National Air Museum to be built in Washington, D.C., the last of the F4B-4s is on display in the National Aviation Museum at Pensacola, Florida.

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BOEING F4B SPECIFICATIONS

	F4B–1	F4B–2	F4B–3	F4B–4
Powerplant	450-h.p. P. & W. R–1340C rated at 6,000ft. at 2,100 r.p.m.	500-h.p. P. & W. R–1340D rated at 6,000 ft. at 2,200 r.p.m.	500-h.p. P. & W. R–1340D rated at 6,000 ft. at 2,200 r.p.m.	500-h.p. P. & W. R–1340D rated at 6,000 ft. at 2,200 r.p.m.
Fuel Capacity*	57–107 U.S. gall.	55–110 U.S. gall.	55–110 U.S. Gall.	55–110 U.S. gall.
Dimensions:				
Wing Span	30 ft. 0 in.	30 ft. 0 in.	30 ft. 0 in.	30 ft. 0 in.
Length	20 ft. 1⅝ in.*	20 ft. 0·69 in.	20 ft. 4·69 in.	20 ft. 4·69 in.
Height	9 ft. 4⅛ in.*	9 ft. 1½ in.*	9 ft. 9 in.*	9 ft. 9 in.*
Wing Area	227·5 sq. ft.	227·5 sq. ft.	227·5 sq. ft.	227·5 sq. ft.
Weights:				
Empty*	1,916 lb.	2,067 lb.	2,202 lb.	2,312 lb.
Loaded as fighter*	2,716 lb.	2,799 lb.	2,918 lb.	3,087 lb.
Loaded as bomber*	3,135 lb.	3,260 lb.	3,379 lb.	3,519 lb.
Performance:				
Max. Speed.	166·3 m.p.h. at sea level	186 m.p.h. at 6,000 ft.	187 m.p.h. at 6,000 ft.	184 m.p.h. at 6,000 ft.*
Cruising Speed	150 m.p.h. at 60% power	158 m.p.h. at 60% power	160 m.p.h. at 60% power	160 m.p.h. at 60% power
Initial Climb	2,110 ft./min.	5,000 ft. in 2·5 min.*	5,000 ft. in 2·9 min.*	—
Service Ceiling	26,400 feet*	26,900 ft.	27,500 ft.	24,800 feet*
Range (normal)	500 miles	580 miles	585 miles	585 miles
Range (max. economy)*	668 miles	738 miles	758 miles	703 miles
Armament	Two ·30-cal. or one ·30-cal. and one ·50-cal. machine guns.			
Navy serials (all numbers inclusive)	*A–8128* to *A–8156* (29 aircraft)	*A–8806*, *A–8613* to *A–8638*, *A–8639*, *A–8791* to *A–8809* (47 aircraft)	*A–8891* to *A–8911* (21 aircraft)	*A–8912* to *A–8920*, *A–9009* to *A–9053*, *9226* to *9263*, *9719* (93 aircraft)
*U.S. Navy figures. (Remainder Boeing material)				

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